

VEGETATIVE DELINEATION REPORT

GIWW TO CLOVELLY WETLAND

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PURPOSE OF REPORT

The purpose of this report is to document the location and extent of each marsh vegetative zone (i.e. fresh/intermediate, brackish, saline, cypress/tupelo swamp), within the management area, from 1992 near-vertical color infrared aerial photography. These data will be used to evaluate the effectiveness of structures and structure management on vegetative communities. This report also depicts the location of selected vegetative data stations used to determine vegetative zone locations. These findings will provide baseline information on the project area's present condition. After baseline information is collected vegetative surveys will be conducted every June to August, at the same stations, to provide spatial and temporal data between flight dates. Five years after completion the project will be flown again and all data will be used to evaluate the effectiveness of the structures and structure management on vegetative communities. The data collected every flight year will be used to measure changes over time and assess the success or failure of the project.

STUDY AREA

The project area is approximately 60,000 acres in size and covers a fresh to low salinity marsh area south of the Gulf Intracoastal Water Way (GIWW) on the east side of Bayou Lafourche and is located entirely within Lafourche Parish. The western shoreline of Bayou Perot and Little Lake make up the eastern boundary of the area and the Superior Canal that services the Louisiana Offshore Oil Producers (LOOP) storage facility is the southern boundary. The objectives of this project are to protect and maintain the large freshwater wetland area through restoration of hydrologic conditions. These wetlands are of great importance not only for the biological future of the Barataria estuary but also for the protection of the developed areas along Bayou Lafourche, (David M. Soileau, et al. 1990). The maintenance of this area is best served by maintaining or reestablishing natural hydrologic conditions that promote: (1) greater freshwater retention and utilization to prevent rapid salinity increases, and (2) water exchange through sheet flow as opposed to an expanding network of tidal channels. Increased salinity in the lower reaches of Barataria Bay has progressed into the southern end of the project area and caused some breakup of the marsh surface. A small band of brackish marsh is located along the fringe of Little Lake and the remainder of the area is intermediate and fresh marsh (Chabreck and Linscombe, 1988).

Freshwater introduction into Lake Salvador, Bayou Perot, and Little Lake will be accomplished via the Davis Pond Freshwater Diversion Structure to be located in St. Charles Parish near Luling, La. Utilization of this source of Mississippi River water will be thru a passive program of sheet flow over the shoreline of Bayou Perot and Little Lake and controlled introduction through low level water control structures at strategic sites in existing man made canals and natural waterways. The major elements of the proposed plan include: (1) isolating the Clovelly Canal, (2) conserving freshwater from pumping stations, (3) maintaining a continuous marsh bankline along the major water bodies, (4) isolating major oil and gas fields, and (5) placing constraints on the future expansion of major tidal channels.

It will be important to address many of the above listed elements of the project area as soon as possible to prevent the imminent loss of some of the high quality wetlands due to the loss of freshwater and from encroachment of higher salinity water from Barataria Bay.

The wetlands of the project area are owned by a limited number of large landowners with an interest in trying to protect their property from additional loss. The wetlands are utilized for hunting, fishing, and trapping by a large number of people through lease agreements with the landowners.

The marshlands east of Bayou Lafourche were formed by overbank flooding of the bayou during the geological period when the Mississippi River used this route for access to the Gulf of Mexico. Natural process of land loss and rebuilding has existed in the study area for thousands of years. River management during recent eras has eliminated silt laden water from entering Bayou Lafourche other than through controlled introduction to reduce pollution and to provide a source of freshwater for domestic and industrial use. The natural terrace of mineral soil along Bayou Lafourche has been isolated from the marshland by construction of storm protection and drainage levees. Most of the marshes of the project area are of the floatant type and are susceptible to rapid breakup.

Changes in hydrology and water quality have direct impact upon plant community composition, size, and viability. Increased tidal exchange aids in transport of fragile marsh soil particles out of the wetlands and allows for saltwater intrusion into areas of lower water and soil salinities. In addition to the impact of tidal action caused by hydrologic alteration, rapid runoff of freshwater occurs. Construction of forced drainage stations in most coastal communities has been adjacent to an outfall canal to expedite discharge of excess water. This practice has accounted for loss of wetlands that otherwise could have been retained thru proper water management programs.

In the absence of supplemental freshwater and sediment from the Mississippi River, maintenance of the U.S. 90 to Clovelly area against the processes of subsidence, sea-level rise, erosion by waves and currents, and saltwater intrusion is entirely dependent on providing a hydrologic regime that 1) minimizes the physiological stress to the wetland vegetation from

excessive salt concentrations or adverse flooding conditions, and 2) is conducive to the retention and accumulation of locally provided sediments. (van Beek, 1989)

Large agriculture areas have been developed within and adjacent to the project area. Delta Farms and Clovelly Farm are the two major sites. Delta Farms has been flooded several times throughout its existence; however, after the Intracoastal Canal levee along the northern edge of the tract broke several years ago, no attempt has been made to dewater the area again. The process of draining organic marsh soils and exposing them to oxidation and decomposition, results in a net loss of surface elevation in a very short time period. Should such sites become flooded again, they will not support emergent marsh vegetation. In some cases, failed reclamation areas provide good fish and wildlife habitat. Delta Farms is a classic example of such an area and provides excellent freshwater fisheries habitat as well as good aquatic plant production for wintering populations of migratory waterfowl.

Several man made canals have had a direct impact upon the hydrology of the project area. Early exploitation of clam shell deposits within the interior of the area was carried out by construction of canals to allow for excavation equipment and barges to transport the shell. An examination of aerial photographs at the Thibodaux office of the Soil Conservation Service reveals that most of the shell deposits had been excavated by 1940. Access to nearby sites were gained thru natural waterways; however, several long canals were dug to gain access to remote deposits in the marsh interior. These canals allowed for an unnatural hydrologic exchange to develop between the remote interior wetlands and the deep water areas such as Little Lake and Bayou Perot.

In addition to the access canals constructed for shell dredging in the interior marsh, the agriculture area at Clovelly Farm utilized material excavated from the marsh to construct the perimeter levee. This activity created an exterior canal system around the property that intercepted natural hydrology.

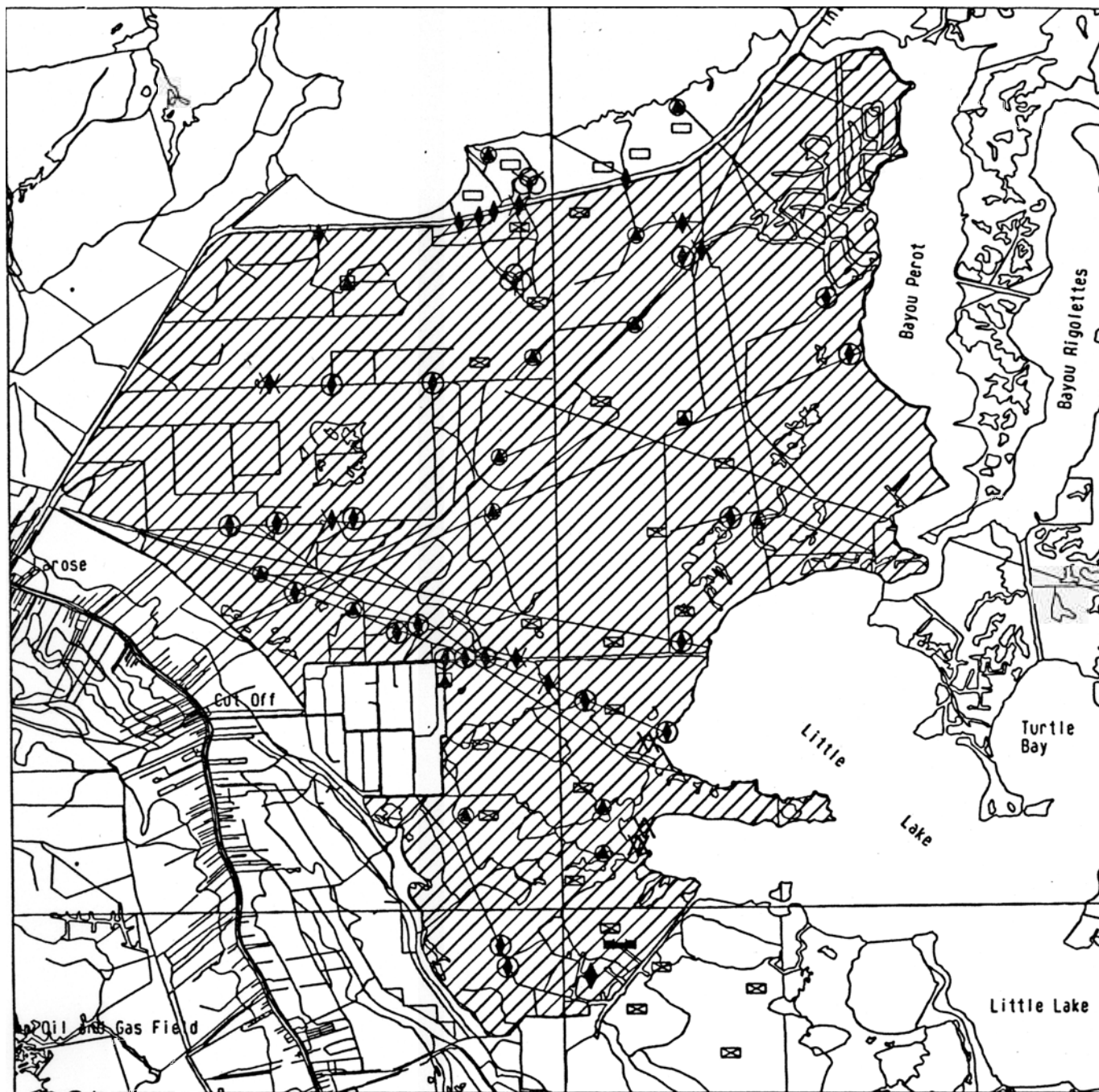
Access to one of the first oil and gas field in the area was through a small canal leading out of Bayou Lafourche and connecting to the Clovelly Farm levee canal. By examination of aerial photos in the Lafourche-Terrebonne Soil and Water Conservation District files dated March 25,

1953 access to producing mineral wells was through the present east-west Clovelly Canal which leads into Little Lake. The connection to Bayou Lafourche has been closed by the expansion of flood protection levees. The Clovelly Canal has been the major access canal for present oil and gas production as well as other boating activity. To gain any degree of hydrologic restoration of the project area, it will be mandatory that this waterway be contained to prevent excessive drainage, tidal scour, and saltwater intrusion. Studies are underway to assess the most practical method by which to accomplish containment of the system and utilize the freshwater resource of the area.

Periodic burning of accumulated plant material has been carried out in this coastal area by trappers for a long period of time. Aerial photographs from 1940 depict large tracts of marshland that had been burned and one fire was burning during the time the photograph was being taken. Plants of fresh and intermediate marsh ecosystems produce extensive amounts of annual growth. Care must be taken by managers when burning this type marsh to prevent getting the root system on fire and cause long lasting damage in the form of deep peat burns that become open water ponds. Small burns during high water conditions in the marsh are the most logical burning techniques.

METHODS

Vegetative zone delineation was performed using color infrared photography (scale of 1:12,000). Vegetative zones were ground truthed on August 3, 1992, November 9, 1992, and April 22, 1993. Permanent vegetative stations were located (figure 1) and species composition, water levels, salinities, landmarks and any other pertinent information was noted at each station. This information was then assimilated into a finalized map depicting project boundaries, vegetative zones and vegetative stations (Figure 2). The percent area of each habitat type and percent open water was calculated using GIS software (Infocad ver.). Details of the methodology can be found in Appendix A.



BA-2 Gulf Intercoastal Waterway to Clovelly Wetland Restoration

- | | | | |
|--|---------------------------------------------|--|--------------------------------|
| | Data Collection Platform | | Plug |
| | Feldspar Marker Plot | | Rock Weir |
| | Salinity Monitoring Station | | Fixed-Crest Weir With Boat Bay |
| | Salinity and Water Level Monitoring Station | | Flapgate |
| | Feldspar Control Marker Plot | | Variable Crest Weir |

Scale 1:144,000

RESULTS

Color infrared photographs were taken on April 22, 1992 and the project was subsequently visited on August 3, 1992; November 9, 1992; and April 22, 1993. During the initial visit, the area was toured to determine access and to view vegetative communities for comparison to existing type map data provided by Chabreck and Linscombe in their 1988 Louisiana Coastal Marsh Vegetative Type Map. A small strip of brackish marsh exist along the edge of the project area from a point approximately at the south end of Bayou Perot Lake southward along the edge of Little Lake to the Loop Canal. Marsh breakup is taking place in conjunction with the openings along the north side of the Loop Canal. Brackish marsh and open ponds will replace the intermediate marsh in this area within a very short period unless the spoil bank along this canal system is restored. Wave action from passing boats and tidal exchange is the greatest in this portion of the study area.

Shoreline erosion is greatest along the lower portion of Little Lake and in many sites; the lake has encroached into the marsh through breaks in the natural rim of the lake. The same general condition exists along the shoreline of Bayou Perot, however, healthy plant communities along a most of this shoreline is providing some erosion protection.

Approximately half of the project area is composed of fresh marsh and approximately half is intermediate marsh. The small band of brackish marsh along the edge of Little Lake makes up less than an estimated 5% of the total area. Two large non-marsh areas exist in the study area boundary. The Clovelly Farm is enclosed by a substantial levee system and is in sugar cane production. The Delta Farm reclamation area has failed and converted into a large expanse of open water which is approximately 5,000 acres in size and approximately 4 feet deep. The area is subject to tidal action through the G.I.W.W. and passing vessel activity causes extensive turbidity in the western portion of the open water. The best fish and wildlife habitat in this lake system is along the eastern and southern shoreline where good stands of southern naiad (*Najas quadalupensis*), coontail (*Ceratophyllum demersum*), and Eurasian watermilfoil (*Myriophyllum spicatum*) are well established and attract large concentrations of wintering waterfowl.

During the second visit to the area on November 9, 1992 an airboat was used to access the interior of the intermediate and fresh marsh portion of the area north of the Clovelly Canal. This provided good coverage of the interior marsh and revealed that there is an invasion of brackish marsh plants such as marshhay cordgrass (*Spartina patens*) and three-cornered grass (*Scirpus olneyi*) throughout the intermediate marsh north of the Clovelly Canal system.

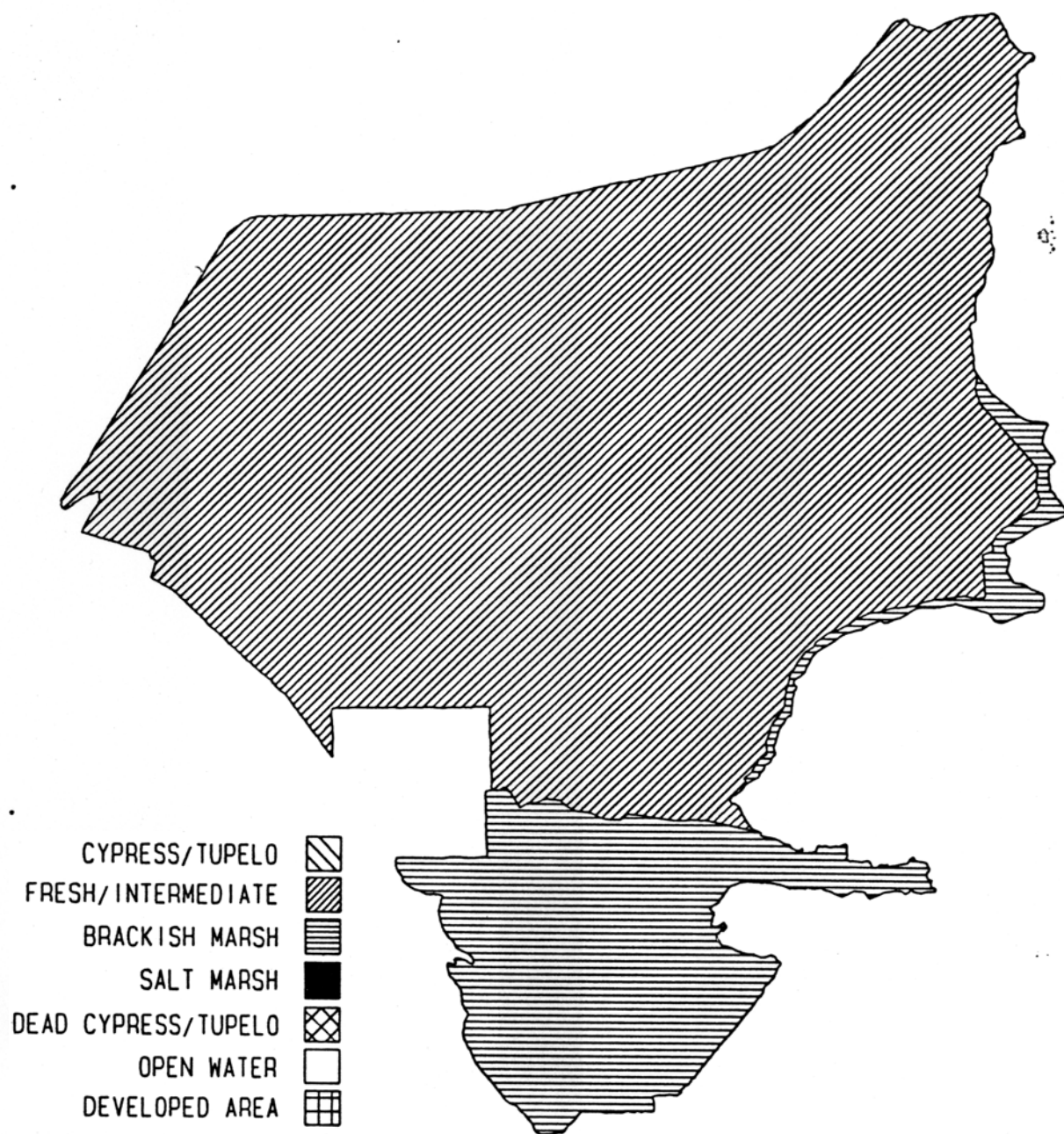
On April 22, 1993 a tour of the southern part of the project area was made by outboard through well developed natural waterways and canal systems. Vegetation in the lower end of the project area has been classified as intermediate by Chabreck and Linscombe in 1988; however, by the date of our field investigation, the area has developed characteristics of a brackish marsh. In addition to this obvious change in plant community composition, several large tracts of broken marsh have developed adjacent to openings in the spoil banks of the canal system. These sites are typical of saltwater intrusion impacts in intermediate marsh and will increase in expanse as well as pond depth due to tidal export unless the openings are closed.

Vegetative station data

Seventeen vegetative stations were established throughout the project area (Figure 2). These stations were located in areas where transition from one vegetative zone to another could be detected. Stations were established along natural waterways in the southern portion of the area to provide long term data for any changes that may occur due to continued salinity encroachment.

Salinities and water levels were taken during the ground truthing effort. Each station was photographed so that repeated sampling can be carried out at or near the same sites in follow up surveys. Each photograph is identified as to direction and typical plants within the general area. Species composition and the dominate vegetative species were noted at each station and recorded by percentage estimation.

Station 1 is located on the east side of the T.G.T. pipeline canal approximately a 1000 feet north of a valve station. This is a brackish marsh with 100 % marshhay cordgrass. There were sprigs of three-cornered grass in the marsh and some bulltongue (*Sagittaria lancifolia*) along the



edge of the canal. Vegetation on the spoil bank was goldenrod (*Solidago sempervirens*), deerpea (*Vigna luteola*), eastern baccharis (*Baccharis halimifolia*), and morningglory (*Ipomoea sagittata*). Aquatic vegetation in shallow water along the edge of the canal was coontail (*Ceratophyllum demersum*) and Eurasian watermilfoil (*Myriophyllum spicatum*).

Station 2 is located along a small ditch running north off of an east-west Exxon pipeline and is approximately at the point where Chabreck and Linscombe established the brackish/intermediate marsh boundary in 1988. The marsh was composed of marshhay cordgrass 85%, three-cornered grass 5%, and bulltongue 10%. This area is drained each time the tide is low in Little Lake and hunters/trappers have attempted to control the water levels with a small wooden bulkhead which has failed. Water salinity was 1 ppt and temp. was 22 C.

Station 2 is located along the south edge of a large interior pond with a lot of aquatic vegetation composed of coontail, southern naiad (*Najas quadalupensis*), fanwort (*Cabomba caroliniana*), and Eurasian watermilfoil. Water hyacinth (*Eichhornia crassipes*) was growing along the edge of the pond area. Salinity was 1 ppt. The marsh along the southwest edge of the pond was marshhay cordgrass 90%, three-cornered grass 5%, and bulltongue 5%. A sparse stand of sprangletop (*Leptochloa fascicularis*) was growing along the shoreline of the pond on old debris. New drift material was located around the edge of the pond which had been deposited by Hurricane Andrew. Large clumps of marshhay cordgrass were observed in the pond that had also been deposited by the hurricane.

Station 3 is located alongside of a trapping access ditch just west of the north-south electrical powerline. The salinity was 0.5 ppt. The marsh is intermediate in this area with marshhay cordgrass 80%, three-cornered grass 5%, cattail (*Typha* spp.) 5%, and bulltongue 5%. Small clumps of sawgrass (*Cladium jamaicense*) and broomsedge (*Andropogon glomeratus*) was noted in this section of the marsh. Nutria feeding activity was very common in the marsh and along the edge of the trapping ditch. Past burning activity in this section of the marsh had produced excellent stands of vegetation.

Station 5 is located at a point where the trapping ditch crosses an old bayou system that has filled with floating marsh. Waxmyrtle (*Myrica cerifera*) was common along the submerged bayou banks and on floating mats of vegetation. The marsh at this station was composed of marshhay cordgrass 70%, bulltongue 20%, and the remaining 10% was a mixture of three-cornered grass, alligatorweed (*Alternanthera philoxeroides*), spike rush (*Eleocharis parvula*) and (*Eleocharis* spp.), sedge (*Carex* spp.), smartweed (*Polygonum* spp.), and waterhyssop (*Bacopa monnieri*). The trapping ditch and other open water sites in this area had a dense growth of duckweed (*Lemna minor*) and common salvinia (*Salvinia rotundifolia*). Salinity of the marsh water throughout this portion of the project area was 0.5 and did not vary.

Station 6 is north of a large shallow pond on the north side of the old bayou system. The marsh is fresh at this site and is composed of 85% bulltongue, 10% smartweed, and 5% maidencane (*Panicum hemitomon*). The marsh is a floating mat of vegetation and is very healthy. The marsh surface water supports stands of salvinia, waterhyssop, and spike rush.

Between station 6 and station 7, we worked our way across the marsh surface in the airboat in a southwesterly direction to the end of a canal system that had been used for access to clam shell deposits. The marsh near this system had a mixture of maidencane and marshhay cordgrass growing together, a clear indicator of increased salinity conditions at various periods of the year.

Station 7 is located north of a pipeline system and east of one fork of the original watershed of Bayou Des Amoreaux. The marsh at this site is 90% marshhay cordgrass and a 10% mixture of waxmyrtle, bulltongue, broomsedge, and three-cornered grass.

Station 8 is located on the south side of the pipeline canal leading northeast towards Bayou Perot. The marsh in this area is fresh but appears to be going to intermediate. Plants at this station were 50% marshhay cordgrass, 30% bulltongue, 10% maidencane, and 10% cattail. There was a dense stand of smartweed as an understory in this area except within the marshhay cordgrass stands. There were sprigs of bullwhip (*Scirpus californicus*) and sawgrass in this marsh. There was an extensive amount of white-tailed deer sign on the spoil banks in the form of tracks and droppings.

Hunters have constructed a large number of deer hunting stands along the spoil banks of each canal and within elevated sections of the marsh interior.

Station 9 is located along an interior trapping ditch leading west toward the southeast corner of the Delta Farms reclamation area. This is a fresh marsh with maidencane 90%, cattail 5%, and bulltongue 5%. Several stands of giant plumegrass (*Erianthus giganteus*) were growing in the elevated marsh and along spoil banks adjacent to mineral access canals. The maidencane marsh is very healthy in this portion of the project area.

Station 10 is located on the east side of the Delta Farms reclamation area. Marsh on the west side of the levee system is composed of 50% cutgrass (*Zizaniopsis miliacea*), bulltongue 40%, maidencane 10% with a mixture of plumegrass and cattail. Large live oaks and hackberry trees are growing on the levee system. The open water portion of the Delta Farms ponds supports a dense stand of southern naiad and coontail. Most of the large canals in this section of the marsh are covered with a growth of water hyacinth.

Station 11 is located south of the Delta Farms reclamation area and northeast of the Clovelly oil and gas field. The marsh in this area is a mixture of fresh, intermediate and brackish plants with 40% marshhay cordgrass, 20% maidencane, 20% bulltongue, and 20% cattail with an understory of smartweed and spike rush. Baccharis, chinese tallowtrees, waxmyrtle, black willow (*Salix nigra*), and roseau cane (*Phragmites communis*) was common on the spoil banks. Water salinity in the canal system at this station was 1 ppt. No photographs were taken at this station due to darkness.

Stations 12 through 17 were taken on April 22, 1993 because we realized that no stations were established in the southern portion of this project in 1992.

Station 12 is located approximately at the break between the brackish marsh zone along Little Lake and the intermediate marsh in the interior of the marsh. This station is along the north bank of Bayou Des Amoureux approximately 2000 feet from Little Lake. Marsh plants in this area are 80% marshhay cordgrass, bulltongue 15%, and cattail 5%. Several patches of iris (*Iris giganticaerulea*) were growing in this section of the area. Eurasian watermilfoil and water-celery

(*Vallisneria americana*) were growing in dense beds within the shallow water portions of the bayou. Clam shell deposits along the edge of the bayou banks contained large numbers of Indian pottery shards and bone fragments. Baccharis, hackberry, palmetto, and black willow were common on the shell ridges. Water salinity was 0 ppt at all stations during this field investigation trip.

Station 13 is located along a trapping access ditch which leads north out of Bayou Des Amoreaux. The marsh plants were made up of 90% marshhay cordgrass, 5% bulltongue, and a mixture of spike rush, three-cornered grass, smartweed, alligatorweed, and baccharis. A mixture of watermilfoil and widgeon grass (*Ruppia maritima*) made up the aquatic plants in the ditch. Common salvinia was mixed with duckweed on the surface of the water in the ditch. The marsh in this area had been burned during early fall of 1992 and spring growth of marshhay cordgrass was excellent.

Station 14 is located adjacent to an Indian midden along the west fork of Bayou Des Amoreaux near the east canal system of the Clovelly Farms. Marshhay cordgrass made up 95% of the plant community with 5% bulltongue. Small clumps of cutgrass and iris were located on the bayou banks. One small clump of buttonbush (*Cephalanthus occidentalis*) was growing on this shell ridge. This plant is very sensitive to salinity and is a good indicator of saltwater intrusion in fresh and intermediate marsh ecosystems.

Station 15 is located at the east end of one of the stub canals that service the oil field (Superior) north of the Loop Canal system. This is a brackish marsh with 95% marshhay cordgrass, 5% bulltongue with three-cornered grass, spike rush, and cattail. The marsh had been burned in late winter and had grown back. The spoil banks were covered with a stand of chinese tallowtrees, hackberry, black willow, baccharis, waxmyrtle, toothache-tree (*Zanthoxylum fagara*), roseau cane, and, elderberry (*Sambucus canadensis*).

Station 16 is located on the north side of the Loop Canal in a brackish marsh that is starting to breakup due to increased water salinity and tidal exchange. Marshhay cordgrass was 90% and three-cornered grass was 10% in this marsh. There was patches of iris and some dwarf spike rush

was growing along the edge of the dry ponds. This marsh area had also been burned during late winter.

Station 17 is located along a small bayou west of Bay L'Ours. This is a brackish marsh with 80% marshhay cordgrass, 10% three-cornered grass, and 10% bulltongue. Spike rush was common within the open space in the marsh interior. Nutria was observed feeding in a large stand of Eurasian watermilfoil in Bay L'Ours at the mouth of the small bayou.

Vegetative area calculations

The project area (59,334.22 acres) is composed of two different vegetative zones. The primary zone represented in Clovelly is fresh/intermediate marsh covering 82.8% of the total project area (49,130.45 acres). Brackish marsh covers 17.2% of the total area or 10,203.77 acres. The majority of the brackish marsh is located on the extreme southern portion of the project area bordered on the west by Little Lake and on the north by Delta Farms. A small strip of brackish marsh exists along the edge of the project area from a point at the south end of Bayou Perot southward along the edge of Little Lake to the Loop Canal.

DISCUSSION

The project area has been subjected to man made changes of the natural hydrology for more than fifty years. Canals excavated to allow for barge equipment to harvest clam shell deposits were attached to natural waterways and were not plugged when the mining operation was completed. This allowed for an interchange of water between the interior marsh and Little Lake. Construction of pipeline and oil and gas access canals augmented the older shell dredging access canals during the 1950's. All of these alterations to the hydrology have had an impact upon the plant communities of this fresh to intermediate marsh ecosystem. Increased salinity levels in the western estuary portion of Barataria Bay have influenced the water salinity and tidal conditions in Little Lake and Bayou Perot.

Long-range management of the area should include efforts to restore the natural hydrology of the area by containing as many of the man made canals as possible within continuous spoil banks. This would assist in retaining the floating marsh physical properties that have contributed to the development and maintenance of the area.

The project area is subject to rapid breakup and land loss due to saltwater intrusion and tidal exchange. Every effort should be made to utilize any source of freshwater in the area to combat the encroachment of water salinity in this portion of Lafourche Parish, La.

APPENDIX A
(Vegetative station photos)

Figure



Figure 4



Figure

Figure 6



Figure 7



Figure 8



Figure 9



Figure



Figure



Figure 12



Figure 3



Figure 14



Figure 15



Figure 16



Figure 17



Figure 18



Figure 19



Figure 20



Figure 21



Figure 22



Figure 23



Figure 24



Figure 25



Figure 26





Figure 29

Figure 30

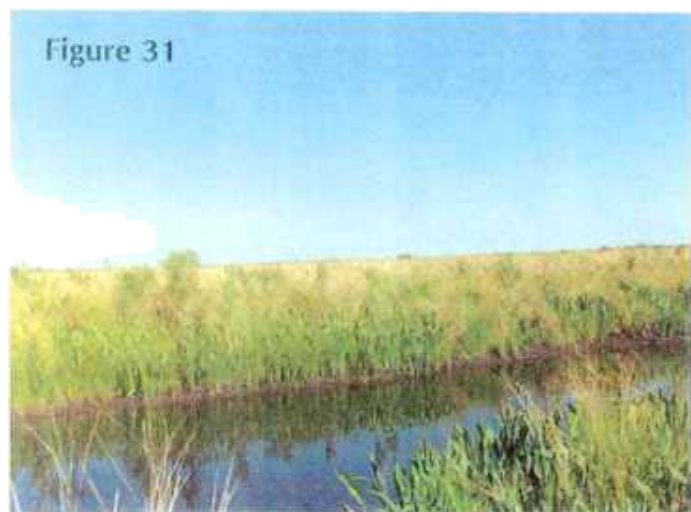


Figure 33



Figure 34



Figure 35



Figure 36



Figure 37



Figure 38



Figure 39



APPENDIX B
(Delineation methodology)

FORMAT FOR AERIAL PHOTOGRAPHY DELINEATIONS

Steps for defining marsh zones from photography:

- A) Obtain color infra-red photography of the project site.
- B) Depending on project size do one of the following:
 - 1) Create a mosaic of the project area in order to view complete project at one time.
 - 2) Use individual prints.
- C) Lay a sheet of clear mylar plastic paper over the photos and attach it to the prints.
- D) Using a 0.25mm pen, outline the project area then outline the areas inside the project that differ in color, texture, height, and/or shape.
- E) Label open water areas and permanent land marks to be used in year to year comparisons on zone location changes.
- F) If historical vegetative data is available for the project area label delineated areas, on mylar, according to this field data with a black permanent marker.
- G) Schedule ground truthing of delineated areas.
- H) Create a plan of action for field trip following these guidelines:
 - 1) Locate permanent stations in each delineated zone and possibly on transition lines.
 - 2) Have 2 to 5 stations per zone depending on the size and possible species makeup of the zone.
 - 3) Establish a possible pattern for investigating each station by numbering them.
- I) Visit project site to perform ground truthing of delineated vegetative zones using the following method:
 - 1) Using an airboat investigate all stations marked
 - 2) At each station collect the following data:
 - a) identify the vegetation in the area, including aquatics, and estimate percent cover by species
 - b) associate identified vegetation in area to the colors, patterns, and textures shown on the photos
 - c) label zones, on mylar, according to the vegetation identified with a permanent marker
 - d) take photographs of area
 - e) take salinity and water temperature readings
 - f) make field notes of water levels, water clarity, vegetative condition, land marks, and wildlife and fisheries encountered

Steps performed in office after ground truthing:

- A) Digitize the boundary of each vegetative zone, in infocad with digital 1990 Landsat data as a backdrop and using prints delineated in the field as a guide.

- B) Locate and label all vegetative stations in the project area.
- C) Assign shade patterns to respective vegetative zone type (i.e. cypress/tupelo, fresh/intermediate, brackish, saline)
- D) Perform percentage and acreage calculations of the four marsh types
- E) Formulate a report including
 - 1) general condition of project area
 - 2) acreage and percentages calculated
 - 3) location of stations with the vegetation and photos corresponding to each one
 - 4) history of project area
 - 5) methods used to evaluate the project
 - 6) figure showing the coded vegetative zone within the project area